

DocMASE Project Proposal 2013-07

Project Title	Wear Characteristics in alloyed transition metal nitride coatings
Main University and Advisor	Linköping University (Sweden) / Prof. Magnus Odén and Dr Mats Johansson Jöesaar
Second University and Advisor	Saarland University (Germany) / Prof. Frank Mücklich
Associated Partner(s) (if applicable)	SECO Tools AB (Sweden) / Dr Mats Johansson Jöesaar Sandvik Coromant AB (Sweden) / Dr Mats Ahlgren
Project Description (with image , if applicable)	<p>Transition metal nitride coatings and especially variants of (Ti,Al,Me)N, where Me is an alloying element, are frequently used by today cutting tool industry in a wide range of metal cutting applications. Typically, these coatings are metastable and undergo phase transformations when exposed to high temperatures which can be favourable for the mechanical properties of the coating and hence are well suited to withstand the harsh service conditions comprising simultaneous high temperatures high pressure during metal cutting.</p> <p>This project will focus on experimental work to involve growth of coatings by cathodic arc evaporation and effect of coating structure, e.g., fine and coarse grain materials, evaluation in realistic metal cutting applications and advanced characterization techniques. The aim is to correlate coating properties with cutting performance to explore the actual wear behaviour and wear mechanisms of the specific coating material.</p> <p>The characterization will focus on analytical electron microscopy techniques, e.g., SEM and TEM in combination with focused ion beam, FIB, together with 3D tomography techniques. Focus will be on studies in the vicinity of the tool-chip contact zone during machining. The obtained results will be important input, not only to the synthesis but also to modelling of the coating behaviour at high temperature and high pressure.</p>
Previous Publications	<p>A. Knutsson et al., "Machining performance and decomposition of TiAlN/TiN multilayer coated metal cutting inserts", Surf. Coat. Technol. 205 (2011) 4005.</p> <p>N. Norrby, M.P. Johansson, R. M'Saoubi, M. Odén, "Pressure and temperature effects on the decomposition of arc evaporated Ti_{0.6}Al_{0.4}N coatings in continuous turning", Surf. Coat. Technol. 209(2012), 203.</p>
References	
Requirements of the candidates / Requirements during the doctoral programme (courses, seminars, etc.)	<p>The student should have a solid background in Material Science or Material physics with an outstanding academic record.</p> <p>PhD duration should be 4 years, the actual duration depends on achievements. 90 ECTS course credits must be completed before graduation among which a maximum of 30 ECTS can be accounted for by courses taken during the Master studies on advanced level if the supervisor approves their relevance. The remaining ECTS course credits must be completed through additional course work.</p> <p>The student selected for this project will work with advanced materials, using state-of-the-art equipment, in one of the world's most prominent lab for coatings and thin films.</p>